Glucose response of horses grazing alfalfa, cool-season perennial grasses and teff across seasons

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Introduction

- Non-structural carbohydrate (NSC) concentrations can vary across different species of forage
- NSC values tend to be lowest in the early morning compared to the afternoon
- NSC levels can also vary between seasons and tend to be highest in the spring and fall
- Elevated NSC values in pasture forage can cause adverse health effects in horses diagnosed with laminitis, Equine Metabolic Syndrome and obesity; total diet NSC should be kept ≤ 10-12% NSC for these horses

Objective

- To determine the impact of different forage species on blood glucose concentrations of horses throughout the grazing season

Materials and Methods

- In May, July and September, horses grazed alfalfa (perennial legume), a mixed orchardgrass and Kentucky bluegrass (cool-season perennial grass mixture; CSG), and teff (annual warm-season grass) pastures (Figure 1)
- Six adult horses were randomly assign to graze one of the three forage types in a Latin square design
- Horses received a 24-hour hay washout and were fasted 12 hours prior to data collection
- Jugular catheters were inserted 1 hour prior to the start of the trial and horses had access to pastures for 8 hours each day
- Jugular venous blood samples were collected from each horse prior to being turned out to pasture (0 h) and then 2, 4, 6, and 8 hours following turnout (Figure 2).
- Forage samples were also taken at 0, 2, 4, 6, and 8 hours and were dried at 60^{0}C for 24 hours, ground and sent to a commercial laboratory for analysis
- NSC was estimated by adding WSC and starch
- Data was analyzed using PROC MIXED in SAS and $P \leq 0.05$ was considered significant

Results

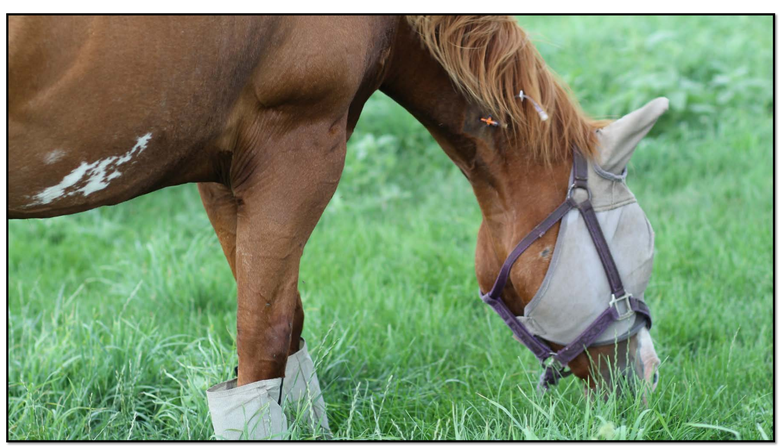
- Daily diurnal variations were observed in NSC for CGS and teff with NSC values increasing throughout the day (Table 1; $P \leq 0.03$); no variation in NSC for alfalfa was observed throughout the day
- Alfalfa and teff had lower NSC values compared to CSG; making them possible forage choices for diseased horses
- Some NSC variation across seasons was observed with higher NSC values found in CSG compared to teff (data not shown)
- Plasma glucose concentrations varied among different forage species at 2 h (P = 0.03), 4 h (P = 0.01), and 8 h (P = 0.02) (Figure 3); however all values were within normal ranges

Table 1. Changes in NSC over time averaged across the grazing season

	Hour						
	0	2	4	6	8	SE	*P*-value
Forage	% Dry Matter						
Alfalfa	9.2	9.4	9.2	9.5	9.3	0.7	0.9948
CSG	9.6^{c}	10.0^{bc}	10.3^{bc}	11.0^{ab}	12.1^{a}	0.4	<0.001
Teff	7.4^{b}	7.9^{ab}	8.4^{ab}	8.5^{ab}	8.8^{a}	0.6	<0.001

^{a,b,c}Values with the same superscript are not different at a *P*-value <0.05

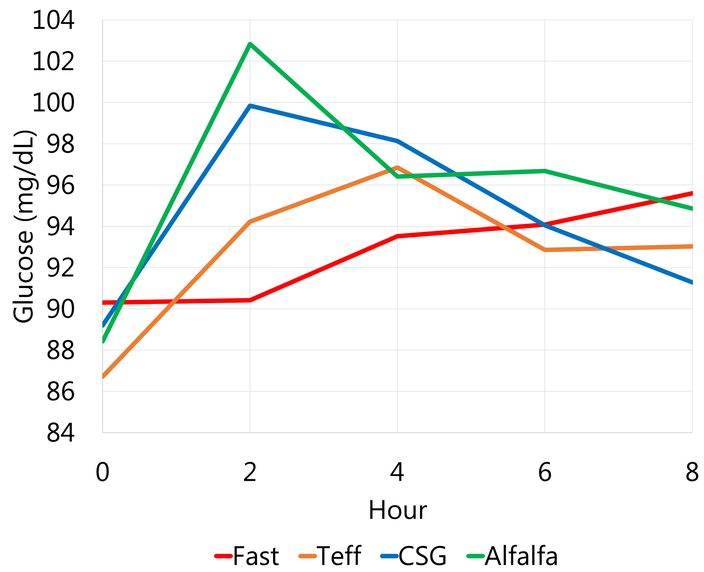
Figure 1. Adult horses grazed alfalfa, CSG and teff pastures during the 2016 grazing season



Results

Figure 2. Jugular venous blood samples were collected from each horse at hour 0, 2, 4, 6, and 8 hours following turnout

Figure 3. Average glucose response for adult horses grazing teff, CSG, and alfalfa during the grazing season



Conclusions

- These results suggest minimal changes in plasma glucose when horses grazed forages species with varying NSC levels
- Future research will evaluate serum insulin levels to further assess the effects of horses grazing different forage types